ADDITIONS TO THE COLLEMBOLAN FAUNA OF HEARD ISLAND

by

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ABSTRACT

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The fauna now consists of 8 species and 2 doubtful records. *Friesea tilbrooki, Cryptopygus caecus, Cryptopygus tricuspis, Isotoma (Sorensia) punctata* and *Isotoma* sp. indet. are new records for the island, and the presence of *Tullbergia bisetosa* and *Cryptopygus antarcticus antarcticus* is confirmed. *Tullbergia templei* was described from Heard I. as was *Friesea viennei* which is here synonymised with *Friesea tilbrooki*, and *Cryptopygus quadrioculatus* is synonymised with *C. tricuspis* after examination of types. Records of *Isotoma (Sorensia) subflava* and *Parisotoma octooculata* from Heard I. are no longer valid since they depend on incorrect identifications and *Tullbergia antarctica* and *Cryptopygus antarcticus reagens* are considered doubtful records. The fauna consists mainly of widely distributed species and there is no sign of endemism.

INTRODUCTION

Heard I. is a small (43 km×19 km) ice-capped Antarctic island lying in the South Indian Ocean at 53°06'S, 77°30'E about 440 km SE of the Kerguelen Is and 4100 km WSW of Perth. Parts of the island are permanently glaciated and it is dominated by a quiescent volcano, Big Ben, which rises to 2745 m (Law and Burstall 1953; Horne 1984). Other areas near the coast and on headlands are free of ice and snow for some months of the year and support vegetation. Seven vascular plants have been recorded. Several collections of Collembola have been made from the island (Table 1). Wise (1970b) dealt with the fauna in detail and listed seven species while the most recent review is that of Deharveng (1981) who did not examine previous collections and gave three definite records and five doubtful identifications. A new collection of Collembola from Heard I. was found to contain two species not recorded before and this prompted an examination of material collected previously and a review of the faunal list. Identifications were made using Deharveng's (1981) keys, descriptions, figures and specimens identified by him unless indicated otherwise. Subspecies have been retained although this should not be taken as support by the author for the concept generally.

TABLE 1. SUMMARY OF COLLECTIONS OF COLLEMBOLA FROM HEARD ISLAND

Collection	Year	Records published by	Institution of Deposition
Deutsche Sud-Polar Expedition	1901-3	Vanhoffen 1908 Enderlein 1909	Berlin?
BANZARE (T. H. Johnston)	1929	Womersley 1937	SAMA
ANARE (K. G. Brown)	1951-2	Brown 1964	USPHTM
P. Temple	1965	Wise 1970b	ANIC (holotypes) BPBM
S. Tremont	1983	Tremont 1983 Greenslade this work	SAMA

The following abbreviations are used: AMNZ, Auckland Institute and Museum, New Zealand; ANIC, Australian National Insect Collection, Canberra; BANZARE, British, Australian and New Zealand Antarctic Research Expedition; BPBM, Bernice P. Bishop Museum, Honolulu, Hawaii; LDColl, Louis Deharveng Collection, University Paul Sabatier, Toulouse, France; NMNZ, National Museum of New Zealand, Wellington; SAMA, South Australian Museum, Adelaide; USPHTM, Department of Public Health and Tropical Medicine, Sydney University.

SYSTEMATICS

KEY TO HEARD ISLAND SPECIES

1 Thorax I carrying setae, not reduced, abdomen V and VI separate 2
Thorax I without setae, reduced, abdomen V and VI fused 5

2 White, ocelli absent, two spines posterodorsally on abdomen VI, grinding mandibular plate and pseudocelli present, furca absent 3
Grey, ocelli 3+3, 7–11 spines posterodorsally on abdomen VI, no grinding mandibular plate or pseudocelli, furca present ..... *Friesea tilbrooki* Wise

3 Empodial appendage present with seta at least half as long as claw ..... *Tullbergia bisetosa* Börner
Empodial appendage absent or rudimentary, lacking seta 4

4 Postantennal organ with 50 tubercles or less, small species, less than 1.5 mm long ..... *Tullbergia templei* Wise
Postantennal organ with 80 tubercles or more, large species, more than 2 mm long ..... *Tullbergia antarctica* Lubbock

5 White, ocelli and pigmented eye patch absent 6
Greyish or black, ocelli and pigmented eye patch present 7

6 Dens about 3 times longer than manubrium, with more than 15 anterior setae and more than 6 posterior setae, mucro with three teeth ..... *Isotoma* sp. indet.
Dens about the same length as manubrium, with 9-13 anterior and 4-5 posterior setae, mucro with 5 teeth ..... *Cryptopygus caecus* Wahlgren

7 Ocelli 2+2 or less, no clavate tenent hairs, mucro with 3 teeth 8
Ocelli 6+6, 2 clavate tenent hairs present on all legs, mucro with 2 teeth 9

8 White with sparse black speckles, ocelli 1+1, dens nearly 3× longer than manubrium with about 8 posterior and more than 50 anterior setae, body with long ciliated macrochaetae distally abundant about 4× longer than ordinary setae on abd V/VI, distal inner anterior margin of the manubrium with 1+1 spines with swollen bases ..... *Isotoma (Sorensia) punctata* Wahlgren
Grey, ocelli 2+2, dens with 5-6 posterior setae and 13-15 anterior setae, dorsal macrochaetae smooth and about 2× as long as ordinary setae on abdomen V/VI, distal inner anterior margin of the manubrium without spines ..... *Cryptopygus tricuspis* Enderlein

9 Dens shorter than manubrium with 5 anterior setae and four posterior setae, mucro with two teeth, macrochaetae smooth and only about a third as long again as ordinary setae on abdomen V/VI ..... *Cryptopygus antarcticus* Willem

i 5 (rarely 4) posterior subcoxal setae on furcal segment and 15-18 anterior sub-coxal setae, 11-18 posterior manubrial setae ..... *Cryptopygus antarcticus reagens* Enderlein

ii 4 (rarely 5) posterior subcoxal setae on furcal segment and 8-14 anterior sub-coxal setae, 9+9 (range 8-10) posterior manubrial setae .....

Family **NEANURIDAE**

1. *Friesea tilbrooki* Wise 1970

=*Friesea viennei* Deharveng 1981 syn. nov.

(Figs 1, 2)

Type Locality: South Georgia.

Material Examined: Holotype: South Georgia, Busen Peninsula, Enten Bay, under rocks on beach, 7.xi.1963, H. D. Clagg, SG 28A, KWSG 216c (BPBM); Heard I., Mt Aubert de la Rue, grassy lawn, 26.ii.1941. Dr Vienne, KWHI 39, (Holotype of *Friesea viennei*) ?LDColl.; Macquarie I., various localities, 32 exs.

Wise (1970a) described *F. tilbrooki* from three specimens apparently with 10 anal spines collected on South Georgia. In 1981 Deharveng described *F. viennei* from Heard I. from a single specimen with seven anal spines. He mentioned that *F. viennei* was close to *F. tilbrooki* differing only in the number of anal spines and in having at least four sensory setae (soies s') on antenna IV compared to *F. tilbrooki*'s three. Re-examination of the type of *F. tilbrooki* shows that it possesses five sensory setae (Fig. 2) in this position and that in all other respects apart from the anal spines it is identical to Deharveng's description of *F. viennei*. The two paratypes of *F. tilbrooki* have recently been examined and possess 7 and 8 spines respectively on abdomen VI (K. Wise pers. comm.). *Friesea viennei* was described with a small tooth to the claw and although *F. tilbrooki* lacks this tooth according to Wise, a small tooth was observed by the present author on claws I and II of the *F. tilbrooki* holotype.

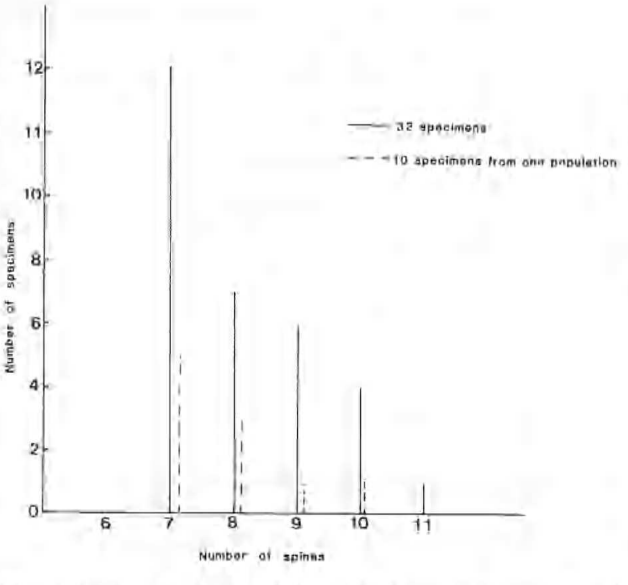

FIG. 1. Number of spines on abdomen VI found on *Friesea tilbrooki* Wise specimens from a number of localities on Macquarie I.

Morphological variation: Examination of a long series of specimens of *F. tilbrooki* from a single locality on Macquarie I. showed that the number of anal spines ranged from 7-11 in adults (Fig. 1) and that this variation had a similar distribution within a single population to that found for all specimens examined. A third of the specimens were asymmetric and seven was the most common number of spines with $a_1 m_1 m_2$ and p_0 always spinose. The holotype of *F. tilbrooki* from South Georgia had m_0 and a_2 spinose also (Wise 1970a, Fig. 2E); one of the paratypes was asymmetric. A single specimen from Macquarie I. had 11 spines (Fig. 2E). No correlation was found between age, size or sex of specimens and the number of anal spines. Bifurcate and double spines inserted in a single position were seen occasionally.

The sensory setae on antennae IV varied in size in adults. Occasionally individuals with 4 or 6 well developed sensory setae were found. The tooth on the claw was small and hard to distinguish. It appeared to be absent in some specimens and on some legs.

Other variation found in the Macquarie I. specimens was in the tenent hairs from fairly short to long and slightly clavate or bent at the tip. The length of the abdominal macrochaetae varied also and when longest they were slightly serrated and bent at the tip.

Deharveng mentions that *F. viennei* has a tendency to plurichaetocity and was asymmetric in its setal arrangement particularly on thorax II and abdomen IV. He compared its plurichaetocity to *Friesea fara* which was studied by Grow and Christiansen (1974).

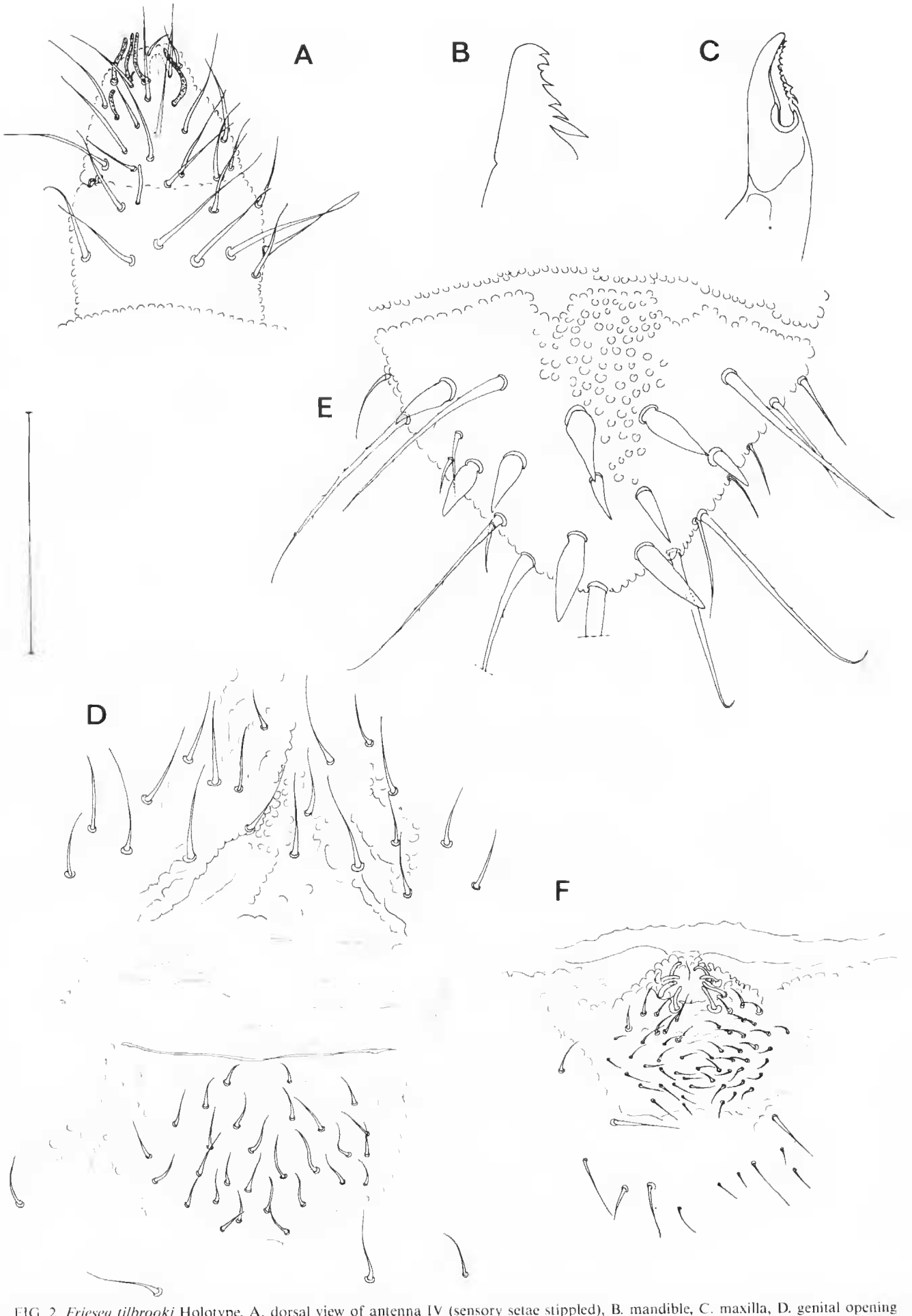

FIG. 2. *Friesea tilbrooki* Holotype, A. dorsal view of antenna IV (sensory setae stippled), B. mandible, C. maxilla, D. genital opening of ♀ specimen from Macquarie I., E. dorsal view of abdomen VI, (cuticle only partly drawn). F. genital opening of ♂. Scale line = 0.1 mm.

These authors noted that another species, *Friesea grandis*, had a "remarkable amount of setal variation" and that specimens were rarely symmetrical. Series of specimens of *F. tilbrooki* from Macquarie I. also showed much variation in setal number and arrangement.

TABLE 2. MORPHOMETRY OF *FRIESEA* SPECIMENS FROM HEARD ISLAND AND MACQUARIE ISLAND

I Macquarie I. Specimens

Number of specimens = 17

Ratio

A dorsal tenent hair III: Int. claw III = 1.062 mean σ = .255
95% C.I. 1.17, .95 range .75-1.45
γ = .1153

B Int. claw III: diam. oc A = 3.2 mean σ = .9481
95% C.I. 3.6, 2.8 range 2.1-5.7
γ = .1484

C anal spine p_0: Int. claw III = .811 mean σ = .19
95% C.I. .89, .73 range .56-1.4
γ = .2950

II Comparison of Ratios

	A	B	C
Holotype *F. viennei* (Heard I.) (according to Deharveng (1981))	1.25	3	7-9 (0.7-0.9)
Holotype *F. tilbrooki* (S. Georgia)	1.46	2.5	0.866
Macquarie I. specimens	1.06	3.2	0.811

Measurements of the dorsal tenent hair and internal claw length of leg III, diameter of ocellus A and anal spine p_0 were made and ratios of their lengths compared with those given by Deharveng (1981) for *F. viennei* (Table 2). Deharveng's value of 1.25 for ratio A (dorsal tenent hair: internal length of claw III), is higher than the mean found here but within the range of these observations. Ratio B (internal length of claw III: diameter of ocellus A) he gives as 3 and ratio C (anal spine: internal length of claw III) as 7-9. The latter figure is certainly a misprint for 0.7-0.9 which falls well within limits found here. This is good agreement considering the variation in size of different spines on a single animal and that Deharveng does not state which spine he measured.

In view of the measured variation within the Macquarie I. populations and known variation in other *Friesea* species (Grow and Christiansen 1974) I consider the specimens from Macquarie I., Heard I. and South Georgia to be conspecific.

No other southern hemisphere species of *Friesea* has the same combination of eye number (3+3), anal spines (7-11) and well developed furca. *Friesea multispinosa* Denis 1947 is nearest, described as having 14-15 spines (13 in Denis' figure), 3+3 ocelli and with a similar furca. Denis (1947) based his description on a single specimen from Kerguelen Island found in a similar littoral habitat in which *F. tilbrooki* is found. In view of the considerable variation in the number of abdominal spines of *F. tilbrooki* and its similarity to *F. multispinosa* in habitat, ocelli number and furca, it seems possible that it is a synonym of *F. multispinosa*. However until the holotype of *F. multispinosa* is examined no change of status of these two species is advisable.

Some additions to the description of *F. tilbrooki* are given below, although details given by Deharveng and by Wise, apart from those already corrected above, still stand.

Antenna IV: 5 well developed sensory setae (soies s), small organite and accessory sensory setae present, single apical bulb with slight suggestion of division.

Mouthparts: mandible with 7 teeth; maxilla with dentate lamella carrying about 12 teeth.

Genital Aperture: ♀ with up to 30 short setae and one pair on anterior lip of genital opening; ♂ with 4+4 broad round sensillae internally and about 50 short setae.

Chaetotaxy: abdomen VI with tendency towards plurichaetocity and asymmetry, $a_1m_1m_2p_0$ (practically) always spinose, m_0 usually absent.

Comments on the biology of this species and details of Macquarie I. collections will be given in a later paper (Greenslade and Wise unpubl. results).

Distribution: Heard I., Macquarie I., South Georgia.

Family **ONYCHIURIDAE**

2. ***Tullbergia antarctica*** Lubbock 1876

Type Locality: Kerguelen I.

First recorded for Heard I. by Vanhoffen (1908) and Enderlein (1909). This record was noted by Salmon (1949), Brown (1964) and Wise (1970b) but it has not been recollected.

The specimens have not been found. This is a doubtful identification according to Deharveng (1981).

Distribution: Antarctica, Kerguelen I.

3. ***Tullbergia bisetosa*** Börner 1903

Type Locality: Kerguelen Is.

First recorded for Heard I. by Womersley (1937). This record was noted by Denis (1947), Salmon (1949), and Deharveng (1981). The species was recollected by Brown and by Tremont.

Material Examined: Heard I., Skua Beach, detritus under rocks, in *Azorella* and in rock crevices, 18.ii.1983, S. Tremont, 26 exs (SAMA); Atlas Cove, beneath *Poa* near elephant seal wallows, 20.ii.1983, S. Tremont, 50 exs (SAMA); Atlas Cove, beneath rocks, in *Azorella* near elephant seal wallows, 20.ii.1983, S. Tremont, 31 exs (SAMA); Heard I, BANZARE coll. 356, det. H. Womersley, 3 exs (SAMA); 31 slides (about 100 exs) K. G. Brown, no further data, (USPHTM).

Distribution: Kerguelen Is, Macquarie I., Heard I.

4. ***Tullbergia templei*** Wise 1970

Type Locality: Heard I.

Not recollected but record noted by Deharveng (1981).

Material Examined: Holotype: Heard I., S. Barrier, Cairn 5, 457 m, 8.ii.1965, P. Temple, (ANIC).

Distribution: at present only known from Heard I. and Macquarie I. (Greenslade & Wise unpubl. results). Deharveng (1981) recorded a species from the Kerguelen Is which he identified tentatively as *Tullbergia* cf. *templei*.

Family **ISOTOMIDAE**

5. ***Cryptopygus antarcticus antarcticus*** Willem 1901

Type Locality: Antarctica.

First recorded for Heard I. as *Cryptopygus antarcticus* by Womersley (1937) and recollected by Brown, Temple and Tremont.

Material Examined: Heard I., Atlas Cove, beneath *Poa* near elephant seal wallows, 20.ii.1983, S. Tremont, 2 exs, (SAMA); beneath *Azorella* on hillside, 1.12.1929, BANZARE coll. 349, det. H. Womersley, 3 exs (SAMA); 12 slides (about 20 specimens) K. G. Brown, no further data (USPHTM).

Distribution: Widespread in Antarctica and Subantarctic islands, ?New Zealand, ?Australia.

6. ***Cryptopygus antarcticus reagens*** Enderlein 1909

Type Locality: Crozet I.

First recorded for Heard I. by Vanhoffen (1908) and Enderlein (1909) as *Cryptopygus reagens* Enderlein. Not recollected although the record was noted by Brown (1964) and Wise (1970b). Deharveng (1981) considers this to be a probable misidentification for *C. a. antarcticus* Willem. The specimens have not been found.

Distribution: Crozet I., Possession I., Ile des Cochons.

7. ***Cryptopygus caecus*** Wahlgren 1906

Type Locality: South Georgia.

First collected from Heard I. by Tremont.

Material Examined: Heard I., Skua Beach, detritus under rocks near *Azorella* and in rock crevices, 18.ii.1983, S. Tremont, 38 exs (SAMA); Atlas Cove, beneath *Poa* grass near elephant seal wallows, 20.ii.1983, S. Tremont, 5 exs (SAMA).

Distribution: widespread in S. America, Australia, New Zealand, Subantarctic islands and Antarctica.

8. ***Cryptopygus tricuspis*** Enderlein 1909

= *Parafolsomia quadrioculata* Wise 1970

= *Cryptopygus quadrioculatus* Wise 1974 nec (Rapoport 1963), nec (Martynova 1967)*

* The two different species described by Rapoport and Martynova and named *Isotomina quadrioculata* were automatically transferred to the genus *Cryptopygus* when *Isotomina* was synonymised with *Cryptopygus* by Massoud and Rapoport (1968).

Type Locality: Kerguelen Is.

First collected from Heard I. by Tremont.

Material Examined: Heard I., Atlas Cove, beneath *Poa* grass near elephant seal wallows, 20.ii.1983, S. Tremont, 2 exs (SAMA); Atlas Cove, beneath rocks near *Azorella*, 20.ii.1983, S. Tremont, 1 ex (SAMA).

Deharveng (1981) notes that *C. tricuspis* from Kerguelen I. and Wise's *C. quadrioculatus* from South Georgia are very close except that *C. quadrioculatus* has only 9 'ventral' (anterior) setae on the dens and that according to Wise's text the species seemed not to have differentiated macrochaetae on the thorax or abdomen except at the extreme posterior end of the body. Examination of the holotype of *Parafolsomia quadrioculata* showed that both dentes carried 13 anterior and 6 posterior setae. Macrochaetae were present as follows; on thorax II 1, thorax III 1, abdomen I 3, II 3, III 2+empty sockets and IV 3+empty sockets. This pattern conforms with that given by Deharveng. The macrochaetae seem to be easily detached. A paratype carried 12+5 and 13+5 setae on the dentes. Other details of chaetotaxy were as follows:

Numbers of setae

	C. tricuspis det Deharveng	*P. quadrioculata* Holotype	*P. quadrioculata* Paratype
Manubrium	13-15	?	13
Furcal subcoxa			
Anterior	13-20	14, 17	17, 21
Posterior	4-6	5, 6	6, 6

In all other respects the holotype and a paratype of *Parafol-somia quadrioculata* agree with the description given by Deharveng (1981) for *C. tricuspis*, and I therefore consider them conspecific.

Distribution: Kerguelen Is., Crozet I., Marion I., South Georgia, Heard I.

9. ***Isotoma (Sorensia) punctata*** Wahlgren

Type Locality: Tierra del Fuego.

Material Examined: Heard I., "from damp situation", 1.xii.1929, BANZARE Coll 356, 1 example, labelled *Isotoma octo-oculata* Willem, det. H. Womersley; Heard I., Poly Gully, from dove prion's (*Pachyptila desolata*) nesting material, 8.ii.1965, P. Temple KWH121, about 19 exs (BPBM); 2 slides (3 exs) K. G. Brown, (labelled *Parisotoma octo-oculata*), no further data, (USPHTM).

This species was recorded by Womersley (1937) and Brown (1964) as *Isotoma octooculata* Willem 1901. Wise (1970b) recorded Temple's specimens as *Sorensia subflava* Salmon (now *Isotoma (Sorensia) subflava* according to Deharveng (1981)). Material has been compared with the holotype of *I. (S) subflava* and found to differ from it in a number of characters of

specific importance; i.e. sensory setae on abdomen V and VI, and chaetotaxy of the manubrium. Specimens are similar to *I. (S) punctata* in these characters and are identified as this species. A revision of the genus is in preparation.

Distribution: Tierra del Fuego, Crozet I., Possession I., Argentina, Heard I. (all other records of this species require verification).

10. ***Isotoma (Parisotoma) octooculata*** Willem 1901

Type Locality: Antarctica.

This species was determined by Womersley (1937) and Brown (1964). Both Womersley's and Brown's specimens are now found to belong to *I. (S) punctata* (see above). Wise (1970b) noted the species record but Deharveng (1981) considers the record of this species doubtful. There is clearly now no evidence to suggest it is present on Heard I

Distribution: Antarctica only (all records of this species from Subantarctic islands, such as South Georgia (in Wise 1970a), require re-examination).

11. ***Isotoma*** sp. indet.

Material Examined: Heard I., Poly Gully, Winston Lagoon, P. Temple, 2.ii.1965, KWHI2, 3 exs (BPBM).

These three specimens were identified by Wise (1970b) as *Sorensia subflava*. They are in poor condition and it is not possible to determine them further than to genus. They are unlikely to be *I. (P) octooculata* since the postantennal organ and chaetotaxy of the manubrium differ from those of that species. Similarly the structure and chaetotaxy of the manubrium differ from *I. (S) punctata*.

DISCUSSION

Of the eight species definitely recorded, six occur widely on Subantarctic islands and the seventh, *T. templei* occurs on Macquarie I. as well as Heard I. (Greenslade & Wise unpubl. results). One species is of unknown distribution. No island endemism was detected. Deharveng (1981) noted some island endemism for the Kerguelen Is, but the fauna of these islands is richer in species, and the islands are larger in area and further north. However the fauna of Macquarie I. with 22 species also shows little island endemism (Greenslade and Wise unpubl. results) and it is at about the same latitude and of the same size as the Kerguelens and near the rich source area of the Auckland and Campbell Islands.

A large amount of morphological variation, particularly in chaetotaxy, was found in these Subantarctic species. Other invertebrates from polar regions have been found to exhibit a high degree of variability (Downes 1965). It has been suggested by Greenslade (1983) that this is because these faunas are subject to A selection where relaxation of constraints on conservative morphology occurs. Whether the variation documented here is due to a genuine divergence of lineages on different islands, or to relaxation of selection pressures or even to the founder effect can probably only be determined by breeding, cytological or biochemical techniques.

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